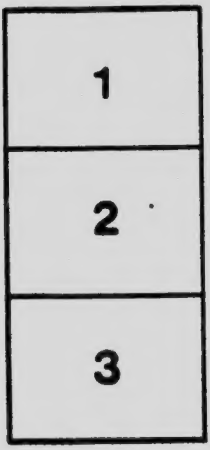

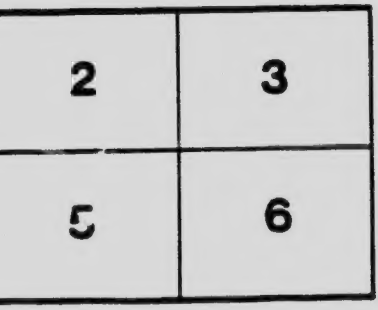

UNIVERSITY OF TORONTO STUDIES

PAPERS FROM THE PHYSICAL LABORATORIES

No. 74: THE DENSITY OF ADSORBING MATERIALS, BY STUART MCLEAN

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The Density of Adsorbing Materials

By STUART MCLEAN, M.A.

Presented by PROF. E. F. BURTON, F.R.S.C.

(Read May Meeting, 1919)

The density of adsorbing materials has usually been found by means of a pyknometer as follows: A tube containing the sample under test is heated to expel the adsorbed gas, evacuated and sealed up. The tube is then weighed and the sealed tip broken off under boiling water which rushes in, filling the pores of the material. After cooling, the tube is placed in a pyknometer and the usual procedure followed.

The following results for coconut charcoal have been obtained by this method:

Richardson[1]	1·6
Miss Homfray[2]	1·67
" "	1·68

The object of this experiment was to apply the volumenometer method to determine these densities. The gas used in the volumenometer was helium because it is not adsorbed at ordinary room temperature.

A diagram of the apparatus is shown in Fig. 1.

The sample under test was placed in the tube X. It was heated to a temperature sufficient to expel all the adsorbed gas and the apparatus was evacuated. Pure helium was then admitted through the Travers siphon T. Let V be the volume of the apparatus above the point M. The mercury in the tube MN was raised to this point and the pressure of the gas measured. Let it be P_1.

The mercury was then lowered to N, increasing the volume from V to V+v. If the resulting pressure is P_2, then by Boyle's Law

$$P_1V = P_2(V+v)$$

$$\text{and } V = \frac{P_2v}{P_1-P_2}$$

whence V may be found, if v is known.

Thus if V_1, the volume with the tube X empty, and V_2, the free volume when the material is in it, are determined, the volume of the

[1] Richardson: J. Amer. Chem. Soc., 1917.

[2] Miss Homfray: Zs. f. phys. chem. 74, 1910, p 152.

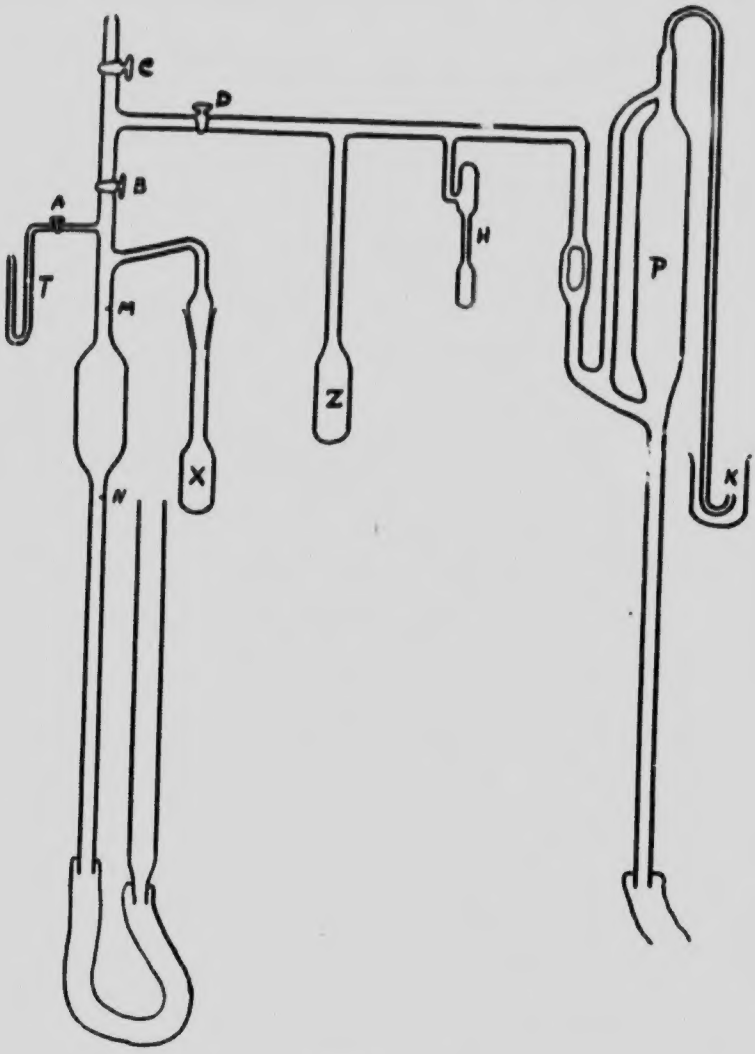

Figure 1

sample is $V_1 - V_2$. If M is the mass of the sample, the density will be:

$$\frac{M}{V_1 - V_2}$$

The following results were obtained:

Sample	Mass in grams	Heated to temperature	V_1	V_2	V_1-V_2	Density
1. Coconut Charcoal	24·4575	400°C	77·38 cc.	61·42 cc.	15·96 cc.	1·48
	25·4324	"	"	61·33	16·05	1·58
	25·5079	"	"	60·65	16·73	1·52
2. Lignite carbonised at 350°C	9·8511	350°C	"	69·99 cc.	7·39 cc.	1·33
	9·9007	"	"	69·89	7·49	1·32
	7·2393	"	"	72·04	5·34	1·35
3. Lignite carbonised at 450°C	9·0903	450°	"	71·11 cc.	6·27	1·45
	9·0599	"	"	71·21	6·17	1·47
4. Lignite carbonised at 550°C	8·5915	550°C	"	71·56	5·82	1·47
	8·5219	"	"	71·47	5·91	1·44
	8·4933	"	"	71·34	6·04	1·42

This work was done under the direction of Professor E. F. Burton.

UNIVERSITY OF TORONTO STUDIES

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